

by James E. Houck and Brian N. Eagle

Hardwood or Softwood?

How much wood could a woodchuck chuck?

It depends on whether he's chucking hardwood or softwood.

The relative merits of various wood fuels are the subject of considerable lore, old wives' tales and personal preferences. Hardwood and softwood are the two major divisions in wood fuel types. The term hardwood is used synonymously with

from the various species within the broad classifications of hardwood and softwood. However, in general, hardwood provides longer burning fires, is denser, dries (seasons) slower, and contains more total heat per volume (cord) but less total heat per unit of mass compared to softwood.

Because hardwood seasons slower, it is often burned when it is wetter than softwood. Softwood has a higher heat content per unit of mass because it contains more resin than hardwood, and resin has about twice the heat content as the other two most common components making up wood – cellulose and lignin. Softwoods make better kindling and, because of resin pockets, tend to crackle more than hardwoods, which makes softwoods valued by some for their aesthetic use in fireplaces.

Some people argue that hardwoods burn cleaner than softwoods, i.e., produce less air emissions and less creosote, while others claim the opposite. Perhaps both claims are true, with hardwood performing better in some appliances and chimney scenarios, and vice-versa. Or perhaps the difference in opinions is due to differences in moisture contents commonly encountered because of the different drying rates.

“Depending on the type of wood and the climate, wood seasoning (air drying) can take from three to 12 months for firewood. The optimal moisture content in terms of minimizing particulate emissions during wood combustion is between 20 and 30 percent. If the moisture content is too high, an appreciable amount of energy is necessary to vaporize the water, reducing the heating value of the wood

*Beech wood fires are bright and clear,
If the logs are kept a year.
Chestnut's only good, they say,
If for long it's laid away.
Birch and pine logs burn too fast,
Blaze up bright and do not last.
Elm wood burns like a church yard mold,
Ev'n the very flames are cold.
Poplar gives a bitter smoke,
Fills your eyes and makes you choke.
Apple wood will scent your room
With incense like perfume.
Oak and maple, if dry and old,
Keep away the winter cold.
But ash wood wet and ash wood dry
A king shall warm his slippers by.*

— Anonymous

wood from deciduous trees, i.e., trees that, with some uncommon exceptions such as western live oak species, lose their leaves every autumn. Oak, maple, hickory and birch are examples of deciduous trees.

The term softwood is used synonymously with wood from coniferous trees, i.e., evergreens. (A few conifers do lose their needles and by definition are not “evergreen.”) Pine, fir, spruce and juniper are examples of conifers. Another way to look at it is that hardwood trees generally have leaves and softwood trees generally have needles and cones. Not all hardwoods are really harder than all softwoods, and vice-versa.

There is considerable variability in the burning characteristics among wood



Cordwood pile in New Hampshire.

as well as decreasing combustion efficiency, which in turn increases particulate smoke formation.


“On the other hand, wood with a moisture content that is too low burns too fast; that (can) cause oxygen-limited conditions, which lead to incomplete combustion with increased wood smoke particulate formation.” (*Environmental Science & Technology*, 1998, 32, 13-22.)

Rapid combustion caused by dry wood can also cause organic vapors to be volatilized and escape before they are completely combusted.

A western softwood, Douglas fir, is specified for the U.S. EPA certification test of wood heaters for low emissions; it is also used for the UL safety standard for solid-fuel room heaters and factory-built fireplaces. Would results be different if a hardwood were used?

While some people are very choosy about the type of wood they burn, on average what is most readily available ends up as fuel. For that reason hardwood use is dominant in most of the East and Midwest, while hardwood and softwood usage is mixed in the West.

The two most common species groups with similar availability for residential fuel in the United States are pine and oak. When the usual preference for hardwood is taken into consideration the balance tips toward oak. White oak, northern red oak, black oak and chestnut oak are the most common oak species used for fuel. Among pines, loblolly pine, ponderosa pine, eastern white pine and shortleaf pine are the most common species used for fuel.

Interestingly, red maple is the single most common wood species used for fuel in the East due to its wide geographic range. Similarly, Douglas fir is a commonly used fuel in the West due to its wide geographic range there. In addition to the oaks, pines, red maple and Douglas fir, yellow poplar and sugar maple are also in the top 10 tree species used for fuel. Many minor hardwood species, when taken in aggregate along with oak and maple, make hardwood, as a group, the most common fuel type in the United States. 

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The easiest and best fire for either a stove or fireplace is achieved with a mixture of softwoods and hardwoods – combining softwoods for easy igniting with hardwoods for longer burning and good coaling qualities.

Percent Hardwood and Softwood Use for Residential Wood Fuel by Selected States

U.S. CENSUS DIVISION	STATE	HARDWOOD	SOFTWOOD
New England	Connecticut	87%	13%
	Maine	44%	56%
	Massachusetts	75%	25%
	New Hampshire	64%	36%
	Rhode Island	84%	16%
	Vermont	71%	29%
Middle Atlantic	New Jersey	70%	30%
	New York	82%	18%
	Pennsylvania	93%	7%
South Atlantic	Delaware	86%	14%
	Florida	68%	32%
	Georgia	74%	26%
	Maryland	86%	14%
	North Carolina	75%	25%
	South Carolina	81%	19%
	Virginia	68%	32%
East South Central	Alabama	84%	16%
	Kentucky	77%	23%
	Mississippi	83%	17%
	Tennessee	90%	10%
East North Central	Indiana	98%	2%
	Michigan	97%	3%
	Wisconsin	96%	4%
West South Central	Arkansas	84%	16%
	Louisiana	84%	16%
West North Central	Kansas	99%	1%
	Minnesota	98%	2%
	Missouri	99%	1%
	Nebraska	96%	4%
	North Dakota	96%	4%
	South Dakota	80%	20%
Mountain	Colorado	27%	73%
Pacific	California	69%	31%

Data from U.S. Forest Service and reports to Tennessee Valley Authority and U.S. EPA.